

# Canadian Computer Wholesaler

THE RESELLER'S RESOURCE

April 1996 Vol. 2 No. 2



How to store it?



Protecting enterprise data  
Terabyte MOs

Optical standard proposed  
DLT for back-ups

The evolution of storage  
Legal wrinkles in out sourcing  
Routers are weak firewalls

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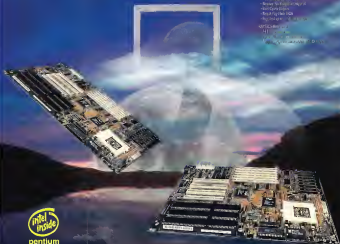
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# CONTENTS



## departments

### Industry Flash

13

### People

15

### Business on the move

17

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## cover story

### Terabyte MO systems provide data warehouse solution

42

Terabyte magnetic-optical systems provide high capacity, economical, and fast data access for enterprises with huge data storage requirements. The media is reliable with an estimated life span of over 30 years.

## feature

### Protecting data in today's network environment

36

The rise of the virtual corporation presents challenges to securing data in the enterprise. Back-ups of the network server and local user data should be done consistently. Network managers must have contingency plans for any event that would interrupt data flow to the enterprise whether it is caused by nature, machine or man.

## storage

### The evolution of storage: Yesterday, Today and Tomorrow

59

Storage systems through the short history of computers, looking back at the early punched paper systems and floppy disks, today's solutions and what the future may hold.

### Optical standard proposed

24

Optical Storage Technology Association is proposing that its Universal Disk Format (UDF) specifications for recording to optical media be adopted as an industry standard.

### Farming the back-end - reaping from historical data

17

Legacy data from way back show trends in the way an enterprise operates. By analyzing this data, better efficiencies and servicing the customer may be gained that could have big payoffs.

### Never enough room on electronic filing cabinet

10

Storage devices are just electronic filing cabinets that never have enough room. Near future developments show storage devices doubling in capacity every 18 months.

## networking

### Token Ring Switching

38

Seamless migration to higher throughput.

### Routers are weak firewalls

30

Setting up a firewall is a complex task and using a router is not the way to do it.

## business

### Legal wrinkles in out sourcing

34

Keeping and storing large amounts of data is a complex logistical task. Out sourcing may be a solution but there are some legal wrinkles one should consider.

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## Empac distributes Iomega Datto tape back-up line

Empac of Markham, Ontario, has signed an agreement with Iomega to distribute their Datto tape back-up products across Canada. This dual formaters Empac's hardware distribution focus. Last year Empac won the Master MVP bowl and was named the number one Master Distributor for Goldstar CD-RD50s and for Seagate hard drives.

The Datto line features internal and external tape drives with a reputation for being dependable and easy to use. The drives use a beltless design for greater reliability, a simple plug and go connection and are 60% quieter and 25% more energy efficient.

## Manuel exclusive distributor of Well Data Line of Rumba software to feds

Well Data (Canada) Inc. and Manuel Canada Inc. announced that Manuel will be exclusive Canadian distributor of Well Data's RUMBA suite of programs in the 1995/1996 federal government National Master Standing Order.

The announcement means one-stop shopping for the RUMBA suite to NMSD authorized resellers.

## Seaton Technology cuts PC prices

Seaton Technology announced it was cutting prices on its systems by up to 20%. Company president, Paul Girard, said the firm's largest computer manufacturer in Canada was able to cut prices because of more favourable terms with its vendors.

Seaton deals directly with its resellers which cut out an intermediary distribution channel. Seaton's inventory levels are lower, and new configurations and falling component prices can be passed on to the consumer quickly.



## Globele to distribute NEC product line

Globele announced that it has signed an agreement with NEC Technologies Canada to distribute its complete line of commercial desktop systems, monitors, Intel-based servers, notebook computers and CD-ROM readers and changers effective April 1, 1996.

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Comshare	1-800-290-9909	4	Purplenet Software Inc.	(604) 213-4281	15
Cyrix	(314) 668-4568	5	Progress Marketing	1-800-481-8664	40
Digital Equipment Corp.	1-800-440-0744	32,33	RC Electronics Canada	1-800-942-3478	28
Dimension Computer Club	(604) 451-1181	17	Ready Computer Inc.	(604) 270-7410	49
Empac Computer Corp.	(905) 945-3600	53	Seaton Technologies Inc.	(604) 669-8668	18, 49
Finch Computers Ltd.	(604) 274-9646	34	SDMS	1-800-677-5504/5	13
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Lapra Marketing	(604) 244-7788	11	White Knight Distributing	1-800-658-0138	23



Dr. Edward Tjephuski

# Never enough room on electronic filing cabinet

**It all starts with information or data.**

**If you look at the bits of data**

**as the DNA of the computer sys-**

**tem, then the hard drives, the storage sys-**

**tems, form the genetic structure.**

As recently as two or three years ago most people were using their personal computers primarily for word processing and spreadsheets. As little as forty megabytes (MB) of hard drive space was adequate to store the information. Today's computer usage model at the very least includes manipulating audio and video multimedia, and downloading from the Internet and the storage needs, or number of copies, go way up. The worldwide growth in information requirements just between 1995 and 1996 has gone up 110 percent.

With memory is getting cheaper the amount of storage required to run applications is no longer an issue. Microsoft Windows 95 or Windows NT, or OS/2 already takes up between 50 and 150 MB of disk space just for the operating system. A 32 bit word pro-

cessor with a minimum amount of business graphics drives a couple of hundred MBs from your hard drive, and if you want to store your user data, there goes another 500 to 500 megabytes. Downloading files from the Internet, takes another 200 megabytes, and if you want to work with video and audio add another 200 MBs.

"If you take a look at the minimum requirements of the portable hard drive on a PC you need a minimum of one gigabyte of information," says Roger Durbey, information storage marketing manager, Hewlett Packard (Canada) Ltd.

It's hard for many organizations to keep up with this phenomenal growth and, rather than throwing out their installed base of technology, they are implementing an upgrade policy. Hewlett Packard's research shows that

the hard drives of 29 percent of all installed computers will be upgraded this year. "If vendors can come up with a storage upgrade strategy for their clients that's a big opportunity," Roger Durbey says.

The smallest hard drive, Hewlett Packard currently offers for the desktop PC is 1.5 gigabytes. By the summer they will be selling a 3.4 gigabyte hard drives for stand-alone PCs and its server drives which currently come with 2 gigabytes will go up to 8 GB. With the ability to double the capacity of any individual device every 18 months Hewlett Packard guesses two years from now hard drives will have three or four times today's capacity.

Compaq Canada Inc. has recently introduced a high capacity 120 megabyte disk drive that uses diskettes that hold 40 times the storage capacity of standard 1.44 MB diskettes and reads and writes to the disk at five times the speed of current disk drives. A single diskette can hold more than 700 business letters or a set of blueprints for a 30-story building. The drive, fully backwards compatible, sells for \$329 and the diskettes are less than \$30 each.

"Applications are constantly taking more and more space on your

*(Continued on page 12)*



## Never enough room on electronic filing cabinet

(Continued from page 36)

drive," Christian Chisholm, Compaq corporate product manager says. "You're always running out of hard disk space. I have that problem myself. You also want to do a quick back-up of critical data and this is a safe and easy way to do it."

In North America hard drives represent 61 percent of sales of all data storage products. In 1996, industry analysts, International Data Corporation, says 137 million disk drives will be sold worldwide. But as the information on the hard drive escalates and becomes more valuable the need to protect and save it becomes more valuable and the need for tape back-up become more significant. And with the growth of laptops outpacing the speed of desktops, a reliable back-up becomes even more vital. Laptops get stolen and damaged more often than desktops.

"Tape back-up matches the sweet spot of the hard drive," says Hewlett-Packard's Roger Darby. "If people feel in 1996 the best use hard drive to have is 1.6 gigabytes, they will buy a tape back-up unit that matches that capacity."

Most of the time when we think of data storage we think of it as being integrated as part of the computer system. But data storage is not always in the hard drive that sits directly in your computer. The method of storing data ranges from magnetic disk technology to magnetic tape technology to optical disk technology, each with its own advantages. Magnetic disks allow for high performance storage of information for quick storage and retrieval. You would choose magnetic tape storage if you wanted to archive your information or to make sure you would never lose it if there was a disaster or calamity. In between are optical disks for situations where speed isn't that important but the ability to store high volumes of information is essential. These different methods are referred to as on-line, near line or off-line storage.

"Whether it's called data storage information storage or mass storage it's still the electronic filing cabinet," says Graham Whitler, storage systems brand manager for IBM Canada.

By focusing only on systems and ignoring storage, Digital Equipment of Canada Ltd. thinks it missed a huge opportunity. Michael Keenan, Digital's storage business general manager, says his company was blinded by the sizzle technology of the CPU and forgot how important storage is for the end user.

"That's really where their valued data is," he says. "Without that data they don't have anything but a bunch of hardware."

With its StorageWorks line Digital is trying to catch up. It reorganized its business units 18 months ago with a focus on storage for high end server systems. Digital found that 90 percent of the initial sale on the average system sale is storage product. Including the follow on business. Mike Keenan estimates that 60 percent of the money spent on the system is spent on Storage. Digital wants to get back some of that business. By regarding storage as simply a byproduct of the sale rather than the sales driver. Keenan thinks resellers are missing the boat much as Digital did. Storage is a way to keep customers by upgrading the system and enhancing it by offering more data reliability and accessibility.

After you've bought the system within the next six months to a year you are probably going to upgrade the disk drive, maybe buy a tape drive or an optical reader," Mike Keenan says.

Seagate Technology Inc. is the largest independent disk drive and components company in the world and just got bigger through its merger with Concor Peripherals. The \$8 billion company, based in Santa Valley, California, works closely with distributors and resellers in Canada. As the technology improves finds it is selling more

powerful higher capacity products while maintaining the same price point. Kevin Perry, product marketing manager for Seagate, sees an insatiable demand for more storage because as the computing environment is changing there is a need for increasing amounts of data.

"Our products are solving pains of magnetic media that serve as the major repository of data that includes applications, operating systems, programs, and data files," he says.

There is a growing appetite for removable media used for back-up or data interchange. To meet the demand Fujitsu Canada Inc. is developing a magneto-optical technology that uses a combination of magnets, optics and laser technology to write data on a 3.5 inch cartridge, the size of a standard floppy disk but a little bit thicker.

"Try to conceive of 230 MB of data on a diskette sized piece of media you can slip into your shirt pocket and take with you," Neil Robertson, storage products manager for Fujitsu Canada says. "These capacities are increasing. Shortly it will be 640 MBs."

With the growing use of graphics and multimedia in business documents, files are becoming large, some as big as 300 megabytes. Sending this much data over the popular Internet take a long time and can run up expensive connect bills. Exchanging the file on the removable medium makes economic sense and is probably a more secure method.

It's big business," Says Neil Robertson. "There is a whole series of technologies struggling for dominance. I see it growing consistently greater than 10 percent annually, may even as high as twenty in some cases. Within two years Mr. Robertson thinks disk drives will be in the 30 to 40 gigabyte range at the top end with the standard disk top having between 3 and 5 gigabytes." □

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### OB Micro heads west

Montreal-based OB Micro Electronics Inc., a distributor of computer memory products is setting up Toronto and Vancouver sales offices. With the offices comes new staff appointments. Thylla Bergen will be Sales Manager, Western Canada.

David Brown, Regional Manager, Ontario will be at the Toronto office.



### Agfa marketing director for digital imaging

Mary Percut joined Agfa's Graphic Systems Marketing team as Marketing Director, Digital Imaging Products.

This new position was created in response to the tremendous sales growth in Agfa's digital imaging products. Mary will be responsible for all marketing related to Agfa products such as desktop scanners and digital cameras.

### David Packard dies at 83

David Packard, co-founder and chairman emeritus of Hewlett-Packard Company and one of the United States' foremost business leaders and philanthropists, died on March 26, 1996 at Stanford University Hospital. He was 83.

A pioneering influence on today's global electronics industry and on modern management practices, Packard made significant contributions in international business and governance during his more than half-century career. The electronics company that he founded with William Hewlett in 1939 in a garage in Palo Alto today is a multinational enterprise with more than 120,000 employees and fiscal 1995 revenue of US\$31.3 billion. The company frequently is cited for excellence in personnel practices, business management, product quality and service - all legacies of Packard's influence.

### Maritel strives for sales excellence

Bill Dotts, Maritel Canada's vice-president, sales, announces the appointment of four new national sales directors to round out the senior management sales team. National directors have been appointed in the areas of education, inside sales, retail, and sales operations. They join sales directors in the W&R and reseller services segments and directors of eastern and western regions.

Rob Glas has been appointed national director, education group. Rob brings to this newly-established sales group experience in sales and marketing with Cengage Corp. and, most recently, as director, education programs for Packard Bell.

Sharon Barlow-Johnston has been appointed national director, inside sales. Sharon brings over 20 years' experience in telecommunications, most recently with MCI and Bell Canada.

David Dukowicz has been appointed national director, retail. With 16 years at Sears Canada as a senior buyer, three years as vice presi-

dent, sales & marketing at Sears, outdoor products, and three years as director of sales at Pack and Bell, David's experience in both retail sales and manufacturing of consumer products has given him a unique combination of experience that will enable him to assess customer needs and opportunities and capitalize on them.

Kevin Baggis has been appointed national director, sales operations. With more than 10 years' experience in distribution, most recently as director, inside sales at Ingram Micro, Kevin possesses a unique combination of retail, analytical, and sales experience.

### Kodak names Holtzman new VP of channel sales and marketing



Kodak Company announced that Mark M. Holtzman has joined the company's Business Imaging Systems organization as vice president of channel sales and marketing for the America Region.

In this newly created position, Holtzman will be responsible for developing and implementing a broader, more comprehensive distribution model for Kodak's document imaging and media components and digital document solutions throughout the U.S., Canada, Mexico, Central and South America.

## BUSINESS ON THE MOVE

### Data General changes name and headquarters

Data General (Canada) is changing its name and moving its headquarters. The company formerly known as Data General Canada will now be called Data General (Canada) Company.

Since March 11, the company has relocated to 350-7070 Mississauga Road, Mississauga, Ontario L5M 3J6. Their telephone numbers will remain the same.

### Empac expands into new office in Richmond

Empac has moved to new facilities to meet the needs of its growing business in British Columbia.

The 16,000+ square feet of new office space and warehouse is at 4611 Viking Way, Unit 186, in Richmond, B.C., phone (604) 821-8077.



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## TAIWAN'S TECH DYNASTY

Being the daughter of Taiwan's leading semiconductor firm is a few disadvantages. Christine Wang, 45, president of First International Computer Inc., has spent decades trying to distance herself from her father, V. C. Wang. The 70-year-old chairman of sprawling Formosa Plastics Group has a passion for controlling every facet of his business. Indeed, Christine founded FIC at the early 1980s in large part because it wouldn't interest her father, who saw no reason to enter the electronics business.

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## Farming the back-end reaping from historical data

By Edward Trupenski

*Data warehousing uses the information that was gathered for productivity reasons and translates as a tool to allow analysis of how the business is running and to define revenue and market opportunities and identify trends.*

Who would believe that resellers and wholesalers in as forward looking and futuristic a business as the computer industry would be benefit from being historians. These are the resellers specializing in data warehousing. The data warehousing integrators help their clients

by collecting information that has been locked away in hard to reach databases or difficult to access legacy systems. They repackage this data into a relational format that allows analysis of variables such as time, geography, personnel, price, or brands. This way their clients can learn from the past

Two of the most prominent data warehouses operating in Canada are SHL Systemhouse Inc. and SAS Institute (Canada) Inc.

"By taking advantage of the information a company generates about itself and its customers it can make better decisions about production cycles, human resources, sales efforts and costing efforts," says Christy DeMont, director of data warehouse operations for Canada, SHL Systemhouse Inc. "Information becomes an asset to manage the other assets."

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"It's not a product," says Paul Richard, general manager of SAS Institute (Canada) Inc. "Quite simply it's a process of turning data assets into information."

While historically databases have existed on legacy systems where mainframes today's workers are more comfortable using the Windows interface, Mr. Richard sees data warehousing as a means to bridge the legacy data to an easily to use transparent environment.

By connecting the disparate databases the data warehouses have a way to organize and utilize all the data. The metaphor for the information is a physical warehouse like IKEA or Price Club. The warehouses are the cases who provide the shelving so that the information isn't stored randomly, but in a logical order. When you come back months later to use the information you don't want to wander the aisles of the data warehouse, metaphorically, trying to find the right piece of information. The tools to "take" the information are like the forklifts in the physical warehouse.

"This helps people make strategic and tactical decisions about the way their company is running," Christy DeMere explains. "They can find information very quickly."

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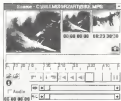
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## Farming the back-end - reaping from historical data

*The businesses that are relating to data warehousing are organizations in competitive industries where even a small strategic advantage can make a huge difference in the fortune of the company.*

(Continued from page 17)

Data warehousing is the step beyond automation in an enterprise. In most organizations computer technology is used to help the company run more efficiently. Data warehousing uses the information that was gathered for productivity reasons and translates it as a tool to allow analysis of how the business is running and to define revenues and market opportunities and identify trends.

The basic components of the warehouse are extraction, storage and access. As a system integrator, the warehouse first copies the data from the existing legacy, manages, monitors, secures it. Then the warehouse de-

signs the storage mechanism and finally creates the front-end tools to access the information effectively.

Building a data warehouse isn't cheap and it isn't easy. As its clients, SAS only makes the top 500 firms in Canada as designated by the Financial Post. You have to have a lot of data in order to benefit from warehousing as it presumes that the company has been around long enough to have developed a history and a body of information. It is also important the client understands of using the data to make strategic and tactical decisions. As a result both SHL and SAS devote a lot of their time to training and education.

The businesses that are relating to data warehousing are organizations in competitive industries where even a small strategic advantage can make a huge difference in the fortune of the company. Retail, packaged goods, banking and governments are good candidates for data warehousing.

"It's all about finding relationships within your information and leveraging those relationships," Clouty DeMont says.

According to the Meta Group, computer industry analysts, 33 percent of organizations are establishing data warehouses. Globally, \$2 billion a year is spent on data warehousing and the Meta Group predicts that this will jump to \$8 billion by 1998.

"Down the road we are looking at innovative distribution methods and a variety of channel mechanisms to drive the sales and servicing of SAS products," Mr. Bechtel says. □

# Routers Are Weak Firewalls

By Sean Erlington

**T**he term *firewall* is being used by marketers of both **application firewalls** and **packet-filtering routers** as a way of addressing common fears about connecting an organization to the Internet. If you are considering a security system to protect your network you should be aware of the significant differences between application firewalls and router based security.

A router can screen packets coming onto your network by using the source and destination addresses contained in the header information on the packet. You can set up filters or rules in the router to permit or deny access to packets entering the router. By and large, however, these are three problems with using routers as a security firewall; they are difficult to configure, they degrade throughput and they are easily fooled.

Routers create rules in order, so when a packet enters the router the router looks to find the first rule which governs the routing of the packet and then stops looking. This makes it critical that rules be entered in the correct order. If you write a restrictive rule and mistakenly enter it after writing a permissive rule, the router may never get a chance to execute the restrictive rule because it finds the less restrictive rule first. Entering rules and determining access groups through a cryptic command line interface can be an exhaustive task and you may inadvertently open up security holes simply by mistyping a command.

Routers were not really designed to act as rule based security filters and using them in such means paying a price in throughput and performance. Some vendors have estimated that adding one rule to a router degrades throughput by 5% to 15% and each additional rule will further decrease performance. By adding an external application

firewall to your network you may actually increase throughput because your routers are now free to do what they do best - forward packets through your network as quickly as possible.

Routers can be relatively easily fooled unless careful attention is paid to configuration. In a *denial of service* attack, for example, a hacker may try to confuse your gateway router by sending fake ICMP (Internet Control Message Protocol) packets telling your router to change its default routing. A hacker may also try an *IP spoofing* attack whereby they send a packet which has a source address which indicates that it originated on a trusted host on your own network. Different routers have varying abilities to detect this type of attack but, generally speaking, if the source and destination addresses seem to be acceptable the router will let the packet through. Remember the default setting for a router is that which is not explicitly denied will be permitted access to the network.

An application firewall is typically a software package which runs on a fairly high powered platform such as a SPARC workstation. Such firewalls range in price from about \$15,000 to over \$100,000 depending on the number of users and licenses required. This compares to approximately \$3,000 - \$5,000 for a gateway router.

An application firewall is a 'dual handed beast', with interfaces to two separate networks: e.g. your network and the Internet. It was not only the network addressing information contained in the packet, but also its higher level protocols layers to analyze the packets. The default position on an application firewall is that which is not explicitly permitted will be denied access to the network. A network administrator must determine in advance exactly what traffic is to be let in and out of the network.

If your organization is looking at purchasing an application firewall system you should keep in mind the following points:

## How viable is the firewall company?

Internet related security is a growth industry with new application firewall companies springing up every month. Many of them will not be in business in a couple of years and you might be stuck with a system for which there is no support and no software upgrades. A large, well financed company has the resources to deal quickly with security threats. If someone finds a security hole which relates to your type of system and ports it on the Internet, your firewall company better have a software patch ready for you shortly afterwards. Larger companies with more R&D resources are better able to respond quickly to new threats.

## How easy is the system to configure?

The easier it is for you to design and input rules the less your chances of making a security error. Look for an intuitive GUI which actually leads you through the process of designing your rules.

**How detailed is the logging?** If your organization is considering adopting a policy of prosecuting hackers then be prepared to deal with law enforcement officials who are not familiar with computer security. Clear, detailed logs which show the events involved in an attack will stand up better in court than cryptic log files which need an expert to interpret. A clear log file will also save you time in the event that your rules cause unintended consequences (e.g. the CEO cannot dial in from home) and you must try to figure out which rule is to blame.

**How much control does it give you over user's activities?** Look for a firewall which gives you detailed control over what your users can do on the Internet. Some firewalls are simply enable or disable such functions as telnet and ftp. More sophisticated firewalls let you determine, for example, that a user can log in some sites but not others, or can get files from a site but not transfer files to a site. A good firewall will also let you determine exactly what web sites your users can visit and at what times they can use the Net. You might, for example, allow your users restricted access to a limited number of "business" web sites during working hours but allow much broader access after working hours.

**Is the solution a scalable, enterprise wide solution?** Your organization may have many security needs - not just protection from the Internet. How will you deal with workgroups which must be isolated from the rest of the company (e.g. do you want the Engineering Department to "see" products originating in the Accounting Department which may contain payroll information)? How will you deal with mobile users, such as salespeople on the road who may need to send confidential information over the Internet via a laptop and a modem? How will you protect desktop PCs which may hold very sensitive information yet must be part of a larger network? Remember the vast majority of security threats to an organization originate outside the company, so don't get so focused on protecting yourself from external threats that you overlook internal security.

#### How sensitive are the firewall's alarms?

Every firewall will indicate when a security breach is underway. Most can page you, send an email, sound an alarm or perform some action in response to an attack. But be careful that you don't set alarm thresholds too low. If a user for example connects logs in five times a week and they are particularly active one week because they are working on a large report, do you really want the firewall to get you out of bed to tell you that? Look for a firewall which will allow you to define "un-pattern" activity as well as full scale alarms. This means that you can keep an eye on activity levels before they reach the alarm stage.

#### Does the firewall allow for controlled administration?

Some firewalls require that the administrator be physically present at a specific console before they can be reconfigured. This is not so bad if you only have one site, but if your company has multiple sites which must be protected do you really want to get on a plane every time you need to make an administrative change to the firewall? A good firewall system will let you set security policies from a central site and then pass those policies through your network to other firewalls around the world in a safe, secure manner.

Finally, keep in mind that an effective security policy involves not only technology but people. You must ensure that your users are trained in proper security techniques such as passwording good passwords and never leaving a terminal unattended without logging out. The creation of a "security culture" in your company is just as important as choosing the right firewall. □

Sean Edgerton is Marketing Manager of ZED Data Systems. He can be reached by [sean@zed.co.uk](mailto:sean@zed.co.uk) or voice (800) 473-8332.

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### Power Up! - New Electronic Highway event first to put public at control stage

The B.C. Freedom of Information and Privacy Association (FIPA) announces a different kind of "Electronic Highway" event - one that puts people, not technology, at control stage. The first annual **Power Up! Electronic Highway Conference and Expo**, June 7-8, 1996, will focus on ways that individuals, organizations and communities can take charge of the highway through education, creating content and influencing the policies which will determine its future.

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### Sceptre release new LCD panel

Sceptre has a new LCD monitor on its in your business. At 2.6 lbs, the resolution-free 12.1" monitor is perfect for places where space is a problem. 13" and 15" models are in the works. The color active matrix monitor has a SRP of \$4,999.

### Merisel to distribute Agfa scanners

Merisel Canada will distribute Agfa's ScanStation line and Accus II scanners. The **ScanStation line** is a 400 x 600 ppi, 30-sec, single pass color/black scanner with a SRP of \$1495. It is bundled with Corepage Direct and a full version of Adobe Photoshop. Available in Windows or Macintosh.

The **Accus II** is a 600 x 1,200 ppi, 30-sec, single pass color/black scanner that comes with a built-in transparency attachment. It comes with a full version of Photoshop and a SRP of \$2,995.



### Key unveils new bar code printers

Key has two new bar code printers, the K4200 and K4300 thermal-transfer and direct-thermal printers. Features fast and powerful bar code, graphic and text printing at an affordable price. The K4200 has a small footprint, advanced memory management, allowing users to store and retrieve labels dynamically, graphics and smooth scalable fonts. The K4300 can print on roll-fed, die-cut, continuous or fan-fold labels, tags and tickets.

SRP for K4200 is \$995. The K4300 is for medium to high volume users and has a SRP of \$1995.

### Epson Ink Jet to produce C-sized color prints

Epson announced the availability of Stylus 1500 a wide-coverage, photo-quality, color ink jet printer for CAD/CAM and business use. The 1500 can print 13.6" x 11.78" on C-sized cut sheet papers and various sized transfer fed paper simultaneously. The 150 x 750 dpi printer has an estimated street price of \$1,399 - \$1,499.



### New notebook from Toshiba

Toshiba of Canada unveiled a new notebook - **Toshiba 7200CDE**. It has Intel i386 MHz Pentium CPU, 12.1-inch 1024x768 resolution Active Matrix color display, new HiQVideo PCI video graphics controller for full screen/full motion video, built-in 28.8 kbps modem and its CD-ROM drive.

### ViewSonic to distribute through Globelle

Globelle Corporation announced that it has signed an agreement with ViewSonic Corporation to distribute its complete line of monitors and power protection devices efficiently immediately.

### Globelle distributes In Focus Systems products

Globelle Corp. will distribute In Focus Systems' line of LCD panel, projectors and accessories. The brands carried by Globelle are the In Focus LitePro multimedia projection systems and PanelBook, SmartView and PowerView projection panels.

### Gates/Arrow more than just pushing HP boxes

Recently Gates/Arrow invited twenty-five of the top Hewlett-Packard (HP) UNIX resellers to a DARL Leaders Council meeting with Gates/Arrow and HP management in Memphis, Tenn.

Gates/Arrow doubled its warehouse space to 327,500 square feet and added a state-of-the-art order fulfillment system called "pick to box." This system allows 12 HP workstations and 6 servers to be loaded with software and tested within 1 hour.

After the meeting, Premier Reseller Awards were made honoring these resellers for their outstanding sales of HP 9600 products during 1995.

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# Optical Standard Proposed

UDF standard stimulates growth in optical technology as economical complement to hard disk drives

By William E. Kapschick

Optical products are gaining widespread acceptance as the data storage medium of choice in an increasing number of applications, including pre-press, CAD engineering and archiving. Some industry watchers even suggest that the booming Internet industry and the consequent need to securely download, edit

and save large volumes of graphical and textual data will only increase the desirability and applicability of optical products for business and personal use. In the near future, business users and consumers alike will use a single, inexpensive optical storage disk as a universal medium upon which to write, modify and delete files con-

taining everything from spreadsheet data to feature-length movies.

While much of the storage industry's attention is focused on consumer applications of read-only, second generation CD (see "Digital Video Disk" in this article, page 26), optical technology is making inroads into other ap-

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ably emerging markets as well. The data and file interchange capabilities upon which nearly all of these applications are expected to be based are specified in the Universal Disk Format (UDF).

Developed by the Optical Storage Technology Association (OSTA), UDF is an easy-to-implement standard that provides an operating-system-independent interface for writing, modifying and deleting files from optical storage devices. Originally developed as an expedient and economically competitive standard for data exchange between writable optical storage devices, UDF is a fully compliant and easy to implement subset of the International Standards Organization's more complex data interchange standard, ISO 13346.

The efficiency and practicality of UDF was quickly seized upon by an ad hoc committee of computer industry companies which prevailed upon OSTA to expand UDF to include compatible file system interchange capabilities for both computer- and entertainment-based media. Today, UDF is the only proven industry standard ensuring interoperable data and file interchange among second-generation, high-density optical storage products. This expanded UDF standard is considered by many of OSTA's member companies as a critical step in developing the optical marketplace for the 21st century, and may well signify the advent of a revolution in the storage industry.

The keys to the success of this revolution are held within three important UDF-oriented challenges. First, UDF's place as the single interchange standard for both TV- and computer-based applications must be universally ensured. Second, backward read compatibility with existing compact disks must be assured. Third, forward compatibility with future read/write and write-once disks must be guaranteed. All of these challenges are technically achievable, indeed, they are being met even today.

### Emerging Optical Technologies

Today, the hottest ticket in the optical world is second-generation CD, variously incorporating recordable (CD-R), erasable (CD-E) and read only (CD-ROM) and digital video disk (DVD) technologies. These devices encompass a wide range of products and capabilities hinged on a few common attributes, including low cost, writability, and sufficient capacity to handle the huge amounts of data found in video and multimedia files. With these technologies, home users of computerized entertainment con-

tents can easily download and store data and video files from the Internet and other sources, author their own video and music CDs, and perhaps online, store and watch entire movies from neighborhood video stores via the telephone.

For the less revolutionary, optical storage products with clear superiority over such storage technologies are also emerging, albeit with less fanfare. One good example is found in the rewritable data storage market.

An increasingly popular application in this market encouraging use of optical storage is the well-established automated storage technique known as hierarchical storage management (HSM). Popular with large data-intensive organizations such as insurance companies and government service providers, hierarchical storage management is an "intelligent" migration solution that automatically stores, finds and backs up files on a variety of storage media within easy access of the user's computer. This software also migrates files to meet on-line random access (optical) or off-line sequential (tape) storage technologies based on a set of rules determined by the system administrator.

The most common alternate storage target for HSM applications has been tape. The constant flow of new files to a hard disk drive triggers the HSM software to move the oldest or least-accessed files to an inexpensive off-line sequential storage technology, typically a tape drive. However, because of the sequential nature of tape, the user's ability to access archived files in a timely manner is inhibited.

Until recently, most HSM software did not recognize optical technology, so near-on-line or even off-line storage to an optical device was not an automatically managed option. Now, OSTA offers the UDF standard as a solution facilitating full data migration via near-on-line HSM applications to and from optical media. This concept is quickly gaining acceptance within the HSM market, potentially expanding the market for rewritable optical storage products by several million units over the next few years. Even so, the optical industry's commitment to expanding the market for optical products does not rest entirely on UDF. OSTA has also defined a number of roadmaps for the development of optical technology, including important milestones for the improvement of data rate and access time, laser wavelength, modulation, encoding and error/suppression technologies. All of these improvements are expected to result in significant increases in the

## Digital Video Disk (DVD)

poised to take  
computer and  
entertainment industries  
by storm

Digital Video Disk (DVD), the low-end consumer application of second generation CD technology, is enjoying more than the proverbial 15 minutes of fame. Product demonstrations at Winter CES earlier this year drew rave reviews from industry watchers and consumers alike, and both the computer and entertainment industries are eagerly anticipating this year's rollout of DVD media and players. Why such a stir? From a consumer vantage point, DVDs will be capable of storing high definition video/audio for feature-length movies and are expected to gradually displace videocassette tape once DVD players become accepted as a commercial product, an effort which will begin in earnest in the second half of 1996. Additionally, with the Optical Storage Technology Association's (OSTA) Universal Disk Format (UDF) file system incorporated into all DVD players and media, consumers will be able to integrate home entertainment systems with PC or Mac computer systems. Using a DVD player, home users will have the capability to view movies on

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their Mac, PC or television with ease, and, with the aid of authoring tools, create interactive multimedia files, animated cartoons, music CDs, video games and home movies at their desktop computer.

True data interchange requires compatibility at both the physical and logical layers. On September 15, 1995, Sony/Philips and Toshiba/Time Warner announced their intention to develop products which support a unified physical standard for second-generation CD, and in the ensuing months these industry-leading companies have consistently moved forward toward achieving that goal. Less well-known — but equally important for complete data interchange — is the fact that both camps had already chosen to design products along OSTA's UDF specifications, guaranteeing that genuine interchange of entertainment-end computer-based data could finally become a reality.

disk capacities of optical storage products, including writable CDs and 3.5-inch and 5.25-inch rewritable optical storage products. These roadmaps are well recognized by members of the optical storage community and are considered the path into the future for the optical storage industry.


If these roadmaps are realized, the computer, entertainment and information storage industries can expect remarkable progress in optical storage technology over the next few years. For example, while the roadmap for first-generation writable CD capacity is 600 meg-

abytes (MB) in 1996, new high-density second-generation CD-R and CD-E products are expected to bear capacities of 3+ gigabytes (GB) and 2+ GB respectively by 1998. Similarly, by the turn of the century, rewritable optical storage products in the 3.5-inch form factor will approach 2.4 GB of capacity per disk and raw data rates of 5 to 10 MB per second. Rewritable optical storage products in the 5.25-inch form factor — ideal for data archiving applications — will have capacities of 10-14 GB with raw data access rates approaching 15 MB/sec.

While ambitious, these roadmaps are not unrealistic. Indeed, endorsed by OSTA

member companies representing some 70 percent of optical storage device shipments indicates that the majority of the industry believes these goals are attainable. Furthermore, when combined with the continued implementation of UDF in products manufactured by OSTA members and computer and entertainment companies worldwide, the roadmaps prove the way for a lasting and successful market for optical storage technology for years to come. □


*William E. Kaganich, chairman of OSTA's board of directors, is also vice president of optical storage products for Verbatim Corporation.*




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# Token Ring Switching

## Seamless Migration to Higher Throughput



Guy  
Maier

**A**s Token Ring technology celebrates its tenth anniversary, it has earned its place in the networking arena. Industry experts estimate that more than 12 million network nodes exist today, and Token Ring networks are growing at an annual rate of about 20 percent. These numbers are proof of significant investment in Token Ring hardware and software. Network managers are now seeking ways to leverage that investment as they expand their networks to support ever-increasing numbers of bandwidth-hungry users and applications.

This article presents four phased migration strategies for extending the life of Token Ring networks. Because evolution, not revolution, is the safest migration strategy, each scenario builds on the existing network infrastructure to provide incremental improvements in throughput while minimizing risk. A key component of these migration strategies is Token Ring switching, a high-performance alternative to two-port bridging.

Many large companies have selected Token Ring technology to support mission-critical applications. Typically, Token Ring networks are bridged networks that carry protocols such as Systems Network Architecture (SNA), NetBIOS, Transmission Control Protocol/Internet Protocol (TCP/IP), and IPX. These networks usually employ a hierarchical design with single or dual backbone rings bridged to end-user floor rings. Bridges and servers are often consolidated in a single location, such as a data center or large wiring closet, to simplify troubleshooting and maintenance.

### Accommodating User and Application Growth

LAN-based applications such as electronic mail, software distribution, and imaging are causing driving Token Ring network growth. As more users populate the network and more client/server applications are deployed, network administrators add rings to minimize fault domains at comfortable levels (typically 50 to 80 users). As rings multiply, additional bridging devices (usually two-port bridges) interconnect them. These bridges are complex to install and require little maintenance. However, they consume expensive rack and floor space and often lack important interconnecting features such as fault tolerance and SNMP management. Customers are looking for a technology to eliminate the large number of bridges without sacrificing network simplicity.

Application growth also increases traffic on the backbone, which is usually the busiest ring on the network. Their traffic loads can congest bridges and affect network performance. Also fading traffic growth are consolidation trends such as that of consolidating departmental servers onto super servers that require more bandwidth than Token Ring can offer. When excess traffic causes a Token Ring LAN to experience throughput problems, servers respond sluggishly or inconsistently to application requests. Servers can also be waiting for acknowledgments from the far end of a connection.

As a result, user productivity also degrades. What's needed to keep pace with continued network growth and increased application complexity is a technology that supersedes LAN-to-LAN

performance and supports connectivity to higher-speed technologies.

Multimedia and other bandwidth-intensive applications exacerbate the requirement for additional network segmentation. Segmentation improves performance by reducing the number of devices contending for bandwidth on a given ring. Servers and power users might want dedicated bandwidth to ensure adequate performance. Other users might require ring segments with fewer devices (10-to-40 users, for example) to support high-bandwidth applications and provide more inherent fault tolerance. In either case, customers need a cost-effective way to segment the network without significantly increasing complexity or space requirements.

### Choices, Choices, Choices

Confronted with these issues, many network managers are looking for a strategic migration path that addresses their performance requirements while protecting existing investments in Token Ring adapters and hubs. The technologies most often considered are routing and switching.

Routers already play an important role in LAN internetworks by providing connectivity between dissimilar media such as Token Ring-to-WAN and Token Ring-to-Ethernet. Some customers have replaced two-port bridges with routers to provide multipoint connectivity. For routable protocols like TCP/IP and IPX, a router logically segments the rings to reduce broadcast propagation. Routing also reduces backbone traffic by keeping local traffic within the subnet. However,

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(Continued from page 35)

for protocols such as SNA and NetBIOS, routers simply support local bridging within the building or campus.

It is more complex to configure and maintain routers than the source-route bridges they replace. Routers also have relatively high latency delays, which can affect user performance, particularly when the router is providing many functions—such as filtering—simultaneously. For these reasons, routers can be more effectively used to interconnect rings or provide multiprotocol WAN connectivity.

## Token Ring Switching

Token Ring switches are high-performance, low-cost alternatives to bridges and routers, they offer connectivity to both large and small LAN segments and to high-throughput and -station. Token Ring switches provide a cost per port that is significantly less than two-port bridges or routers.

This cost factor becomes increasingly significant as workgroup and departmental LANs are segmented to provide additional bandwidth, since segmentation increases the number of LAN-to-LAN connections. Switched technology makes it practical to create LAN segments to support high-end servers—and eventually even single stations—requiring high-bandwidth connectivity.

Switching is a relatively new concept for Token Ring networks, and the term is used in several contexts. Some hub vendors offer Token Ring port switching, which electronically moves a device from one Token Ring to another—basically an electronic patch-panel function. True Token Ring LAN switching transparently replaces existing bridging solutions in addition to simplifying adds, moves and changes. In this case, each port on the switch represents its own ring, which can communicate with other switched rings without external bridging and routing. That is, each port becomes an interwired LAN.

Switching also provides a migration path to higher-speed backbone technologies such as FDDI, Full-Duplex Token Ring, and ATM.

- 100 Mbps FDDI is a mature technology that already has a significant presence in Token Ring networks. Due to high-availability features and similar token-passing methodology, FDDI is a natural step for high-speed Token Ring networking.

- Full-Duplex Token Ring is a part of a future R02.5 standard called Dedicated Token Ring (DTR). Full-Duplex Token Ring can boost the

bandwidth of busy devices from 16 to 32 Mbps. Many Token Ring adapters are already enabled for full duplex and require only updated microcode for full-duplex connectivity with Token Ring switches.

- ATM, for which standards are being finalized by the ATM Forum, is the ultimate campus solution because of its high data capacity—up to 155 Mbps per port—and its ability to transport voice, video and data simultaneously. The ATM LAN Emulation standard, approved in February of 1995, enables legacy equipment and applications to communicate using ATM.

## Migration Steps

Network managers considering the migration to Token Ring Switching can follow many paths, depending on their specific requirement. The following four migration phases represent conservative steps for large bridged networks.

To reduce network disruption, maintenance headaches, and the risks and costs of migration, each phase leverages as much of the existing technology as possible—both hardware and network configurations—and preserves the network infrastructure. The latter point is particularly important in Token Ring networks that currently mix source route, transparent, and source route transparent (SRT) bridging.

Some Token Ring switches support source-route bridging only and will not pass transparent packets. While switches that support transparent routing can pass source-routed frames, a network with dual backbones and multiple Token Ring interface copiers (TIC) attachments configured with identical MAC addresses—a common redundancy scheme—will not function as expected unless a source-route bridge sits between the TIC attachments and the rest of the network. By using a true SRT switch that can forward source-route and transparent packets, network manager can improve throughput while maintaining compatibility with the current environment.

### Phase 1: Replace Backbone Bridges with Token Ring Switches

The first phase provides finer segmentation, simplified management, and better performance by replacing multiport backbone bridges in the data center with Token Ring switches. Without making any changes to end-stations and servers on existing rings, this migration step has the following direct benefits:

- It provides Token Ring-to-Token Ring networking with higher throughput and lower latency delays.

- It allows network managers to add more segments and more users to the ring while maintaining peak domains at comfortable levels (50 to 100 users). Token Ring switches can quadruple the number of ports provided by the two-port bridges they replace.

- It replaces multiple two-port bridges with a single device, thus simplifying network administration.

- It prepares the way for migrating to higher-speed technologies.

### Future Options - Full-Duplex Token Ring

One option for this migration step is to segregate busy devices like high-speed server from multi-user rings onto a dedicated port on the Token Ring switch. Upgrading these devices to Full-Duplex Token Ring can potentially double the bandwidth to those devices without affecting the existing network infrastructure. While the Full-Duplex Token Ring specification is still under discussion among the standards bodies, network managers with an eye toward the future can keep this option in mind by installing Token Ring switches that can be upgraded with software to support Full-Duplex Token Ring once approved.

### Phase 2: Add High-Speed Technologies for Better Performance

As user populations and bandwidth requirements increase, the campus/building backbone (ie the data center) is an obvious candidate for upgrading to high-speed technologies. While ATM as a technology standard is a work in progress, FDDI might be a more pragmatic choice for today's networks. However, the choice is not an either/or situation. With the right switching equipment, users can choose between migrating to FDDI as a stepping-stone to ATM or moving directly to ATM. ATM-capable switches with ATM Forum LAN Emulation allow existing applications to access an ATM backbone via protocol stacks like APPN, NetBIOS, TCP/IP and IPX as if they were running over traditional LANs.

This phase simply adds an FDDI or ATM download to an available switch port to connect servers and other switches on the new high-speed backbone. If the download is a field upgrade to the switch (and the switch should have this capability), the new technology can be completely tested before migrating production users. A key benefit of this step is that it relieves congestion for busy devices such as servers.

One important note: some Token Ring switches support FDDI simply for aggregating Token Ring-to-Token Ring traffic and cannot accommodate FDDI servers on the link. It is important to choose Token Ring switches that provide true FDDI concentration and allow different types of devices to communicate over the FDDI backbone.

### Phase 3: Add Workgroup Switching for High-Bandwidth Users

For workgroups with heavy high-bandwidth application use, floor-based switching can help improve throughput by allowing floor segmentation. By adding a switch at the floor level, 50 to 80 user rings can be split into much smaller rings, each with fewer users. A single downlink to the high-speed backbone installed in Phase 3 provides all workgroup rings with high-throughput access to mainframes and server farms. This step provides three key benefits:

- It reduces the impact of heavy users on other users.
- While each user enjoys improved performance, the existing network infrastructure of the

workgroup is preserved.

- Network managers can segregate end-stations with office 4 Mbps Token Ring adapter cards from end-stations capable of supporting 16 Mbps. With a simple reconfiguration, users with 16 Mbps capability get a 4-to-1 bandwidth increase, while maintaining a 4 Mbps adapter network intact.

### Phase 4: Introduce Single-Station Switching for Dedicated Bandwidth

The low cost per port for Token Ring switching provides another way to increase bandwidth without changing end-station adapter cards—the use of single-station switching. This solution virtually eliminates the possibility of a LAN connection becoming a bottleneck.

In the future, as the cost of switching per port drops further, a switch could provide dedicated bandwidth to end-stations in the periphery of the network—as close as possible to the end-user. The result would be dedicated 4 or 16 Mbps at the desktop with extreme fault tolerance, all the while taking full advantage of existing adapters.

In this way, single end-station switching could extend some benefits of ATM as close as possible to the end user without the need for an ATM adapter card. Each user could connect to a Token Ring switch with ATM LAN emulation, and then link to a backbone ATM switch. The result effectively provides ATM to the desktop while preserving the existing network configuration.

Token Ring is a valuable networking technology for today and tomorrow. The inherent robustness of Token Ring technology allows many Token Ring network managers the luxury of planning migration to new technology, rather than reacting to immediate network problems. By including Token Ring switching as part of the migration plan, network managers can separate the most value from existing infrastructure investments, provide additional capacity for a growing user population and high-bandwidth applications, and lay the ground work for further migration to high-speed technologies. □

*Gus Mofetta is general manager of JCom Canada Inc.*

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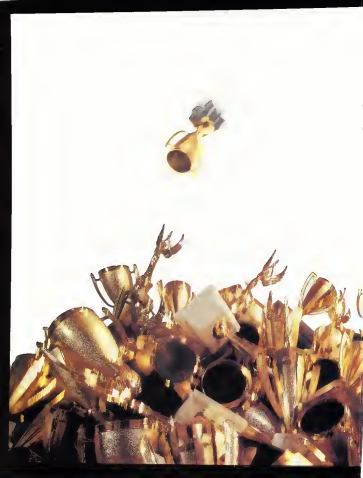
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# Data Warehousing

## - an exercise in out sourcing

**T**he amount of data being produced and stored is increasing exponentially. For many, out sourcing the storage function is a viable alternative. With the growth in web server technology, many organizations are already moving in this direction without even recognizing it.

An awareness of the broad issues involved can make the job easier when deciding on whether to out source a data processing function.

Data warehousing has been around for a long time in one name or another. There is nothing

magical about the concept. It is simply a sub-set of the contracting out of computing requirements. And it can go from simply renting space on a main frame computer, to having all of an organization's data storage and processing functions, including report writing, prepared by a service provider.

The upshot of this is that the broad issues concerning data warehousing are in large part the same as those surrounding out sourcing other computing needs.

Traditionally, out sourcing has been used by companies possessing large amounts of data.

By definition, these companies are themselves usually large. With an increasing number of companies maintaining a world wide web presence, smaller companies are also becoming involved.

The decision to out source cannot be divorced from the issues of implementation. Storage of data and cost are responsible topics when talking hardware. So, too, indeed, is the organization which makes the decision to out source, based solely on cost considerations, without a careful examination of whether it can maintain the necessary degree of management control over the service provider. When it comes to out sourcing, cost should be the definitive factor only after a careful consideration of all other management issues.

There is a payoff for working through the entire process before making the decision. The reasons will be much clearer, the benefits that can reasonably be expected will be quantified and areas where the potential risk of failure will have been identified. In anyone's language, this translates into an increased likelihood of success.

So what are some of the broader issues that might impact on the decision making process?

When it comes to data, it is surprising how often the question of security receives barely more than lip service. Maybe it's the "Canadian way", but it is a fact of life that the theft of information is a reality that should not be ignored.

In areas of rapid technological change, prudent management goes beyond

seeking the usual contractual assurances about security. The only safe way to maximize protection is to review, in whatever detail is reasonable in the particular circumstances, the process by which the service is provided. There is a deeper message in this. The industry is young, and growth is often rapid. Service providers are in the same learning curve as their clients. The process of identifying issues and recognizing solutions is not mature. And because growth may have outstripped both capacity and capability, your provider may be over estimating its ability to perform. Sound familiar?

While it may not always be necessary to perform this added investigation, for now, it is the recommended twin to contractual protection.

While each organization differs, the degree that the desired management controls are recognized and incorporated into the arrangement, the better off the management will be. The identification process is often easier said than done, for much of the power (particularly operational) is taken for granted when performed within the organization. When the process is moved outside the organization, the loss of control can become noticeable.

Striking a balance between the service provider and the organization can be an issue on its own.

Issues can be categorized into those relating to the delivery of the service, and those relating to change. The latter are often the most difficult to incorporate into an agreement, because by definition



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they require some gazing into the proverbial crystal ball. Examples of changes are those that relate to shifts in organizational priorities, the need for different information at different times, changing regulatory requirements, the introduction of new technology and decreases in available funding.

What can be expected from advisors (including legal counsel)? Using the analogy of corporate counsel, there has been a shift in what is demanded of them. These changes are instructive from the point of view of what you might expect. Gone, in large part, are the days when lawyers were looked to as managers of the compliance process, and as providers of the straight-forward day to day legal services required by the company. Corporate counsel are expected, more and more, to be part of the management team. They are expected to have a level of knowledge of the business and strategy that adds to management. In short, their function now goes far beyond implementation and operations.

The corollary to this is that an experienced advisor should be able to help you anticipate management issues that you might encounter and suggest solutions reflecting not only a knowledge of the legal issues, but also an awareness of how the industry works. Seeking this advice during the decision-making phase of the process may markedly improve the quality of your project.

Hand in hand with this goes an increased awareness of the ownership aspects of knowledge. We are entering an age where information and knowledge are being procured over manufacturing. Following this we have witnessed an increased sensitivity, voluntarily and sometimes enforced, to issues of privacy. In the case of government and its institutions, these issues

have been expressed around freedom of access to information.

Both British Columbia and Ontario have legislation governing access to information and privacy issues, as does the federal government. To over simplify, privacy issues translate into security issues, reinforcing the need to secure your data. Freedom of information is a thornier issue.

The legislation now extends to crown corporations, health care institutions such as hospitals, and municipal governments. In short, the legislation covers the very kind of institution that might look for an out sourcing solution.

The legislation obligates an organization to be self-policing. In other words, the organization has a positive duty to produce information in accordance with the statute. If it does not, there is a review process provided for by an independent privacy commissioner who has the authority to make decisions (and order the release of information). Compliance with this legislation can be a very costly exercise, and one which has the potential for influencing the way in data bases are designed.

An organization subject to this legislation may also want more external management control over the process of data warehousing than one that is not.

And just when it starts to look like you are finished, the task is then to devise structures that give the necessary legal control over the out sourcing process without unnecessarily hampering the delivery of the service. But more on that another time.

Want to read about a particular topic? E-mail your suggestions to [gary@blum.com](mailto:gary@blum.com)

Gary Dene practices law in Vancouver, B.C. relating to computers, intellectual property, and licensing. He can also be reached at (604) 239-7011.

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# Protecting Data In Today's Network Environment

By Jim Kaufmann

With the rise of Virtual Corporations, companies are forming temporary strategic alliances and assembling temporary teams to take advantage of fast-changing business opportunities, solve problems and handle short-term situations.

The undercoverage that supports these flexible workgroups is the organization's network. Protecting the volumes of data on these systems and maximizing network performance have become a challenge for network managers.

Network managers who don't implement an automated method of protecting their data are taking major risks—not just from the disasters that you see on TV (weather/environmental-related disasters and sabotage) but the more common disasters which can range from casual file loss, insider-out user deletion, power failure, hard disk loss, virus, and intentional acts.

The cost of even a simple disaster, in terms of both network downtime and hard dollars, is spiraling out of control (Illustrations 1, 2).

Even simple backup procedures can assist the network manager in restoring the network after a disaster strikes. However, complete protection requires consistent backup of local user data as well as vital corporate files on the server. While the new server-side backup and recovery applications can automate the data protection tasks, ideas about storage solutions are changing.

(Continued on page 38)

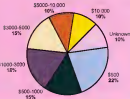
The Cost of Daily Disasters

Illustration 1

Network Downtime per Week



Estimated Hourly \$ Loss



Source: Geller

Illustration 2

Rising Storage Management Costs  
(Major Components)



Source: Strategic Research

0.0% 5.0% 10.0% 15.0% 20.0% 25.0% 30.0% 35.0% 40.0%

Percent of Median Total

Jim Kaufmann  
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(Continued from page 35)

### Hard Drive Performance, Economy of Tape

For end users, the write transfer rate has remained the key consideration in choosing a backup storage system—organizations want hard drive performance and the economy of tape. With the new standard compliant 2.6GB drive-overwrite (DOW) magnetic-optical (MO) drives, the data-overwriting process is reduced from the two-pass process required with present MO systems to a single pass—also a consideration in that a major impact on performance when storing large files or performing backups. Network managers now have a high-capacity solution that meets the performance of hard drives. In addition, the media provides substantially longer data reliability and a longer data life than either hard drives or tape.

### Not Just Backup, Recovery

When implementing a backup program, management should ensure that the program not only safeguards the data, but also simplifies data restoration and disaster recovery.

Optical disk storage systems definitely have the edge over tape systems when it comes to retrieval. Since taped data is stored sequentially, locating a file is time-consuming—users wait while the tape winds one direction or another in search of the requested information. Optical storage, on the other hand, records data randomly. Locating information takes seconds.

### Media Life Affects Total Cost

While the new DOW drives can be used with non-DOW 680MB, 1.3GB and 2.6GB erasable media as well as DOW write-once media, the 2.6GB di-

rect-overwrite media must be used in order to achieve the faster write speed. In comparing storage costs, the DOW media is 3¢ per Megabyte and the average cost of tape storage is approximately 1¢ per Megabyte. However, when figuring the actual costs, it's important to consider media life. While tape tends to be replaced once every six months or so, optical media can last a lifetime. So, in the long run, optical media is actually a lot less expensive.

### Increased Security

Although the cost of optical disk media has come down, its durability has increased. The media retains data integrity for 10 years or more. And unlike magnetic-based storage systems, optical disks are unaffected by head crashes or any magnetic fields. Once information is recorded onto the disk, it will remain there until—in the case of erasable media—it is overwritten with new data.

Optical disk media is the most rugged storage media available. It not only retains its data integrity for more than 10 years, it can be removed, stored, mailed, carried, shipped or loaded with little concern about potential damage. To protect against the devastating effects of fire, floods or other disasters, the backup disks can be sent to off-site locations. While tape does allow some portability, it does not provide the durability and flexibility of optical disk media.

### Disk Mirroring

With the new high-capacity, high-performance optical drives, firms can implement disk mirroring programs when fault tolerance is a prime concern. When an optical drive is used to mirror

the server's hard drive, it shares the cost similar with the server's primary disk. Each update is written to both drives. When the primary disk fails, users are automatically switched to the mirrored optical drive, with all files intact (up to the last backup).

Mirroring hard drives using high-speed direct overwrite MO drives doesn't eliminate or reduce the need for backup. However, it does provide another layer of protection.

After all, the objective of disk mirroring is to provide levels of data redundancy, fault tolerance and performance. Even this data needs to be periodically backed up and protected. In these types of applications, backup can be viewed to be even more critical, since the loss of data can represent the loss of considerable time and potentially millions of dollars.

If a file is corrupted or erased on the mirrored optical system, both copies will be completely unusable. In organizations where documents and data must be continuously available with a loss is unacceptable.

Unlike mirroring, backup is an application that completes a function (copying) and is then inactive until the next backup is scheduled. Backup is useful to make "insurance" copies of data for use when the hard disk fails.

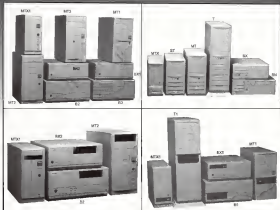
For added insurance, a complete set of backups is stored in a secure location, generally off-site.

The cost of managing and recovering data far outweighs the cost of purchasing the hardware and software. Backup is like an insurance policy. However, with so much mission-critical data being stored on today's PCs, workstations, servers and mainframe systems, new storage/retrieval solutions are needed. The capacity and performance improvements of the new direct-overwrite MO drives have opened the door for the use of optical mainframe data dumps applications and represent a serious challenge for tape systems in the area of data and image backup. □

(Continued on page 46)

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(Continued on page 46)

## THE RISKS AND THEIR COSTS

People who have found themselves in a hospital following an auto accident are usually the most staunch defenders of mandatory laws for seat belts.

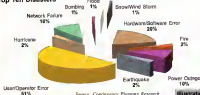
The same is true for people who insist on system backup. In fact, according to IntelliQuest, a market research firm in Austin, TX, data protection policies are most often initiated only after a disaster or a simple, negligent act causes large amounts of data are lost (Illustration 3).

IntelliQuest reports that American firms spend nearly \$5 billion because of data loss and that companies devote nearly 35 million business days each year to recovering lost data. When you consider that more than half of all PC users will lose large amounts of data during their careers, the ramifications can be enormous. This is especially true in today's productivity and profit-driven economy IntelliQuest's backup study found.

- Thirty-two percent of the respondents reported that their companies had a formal data backup policy in place.
- The mere existence of a formal policy may not be enough. Eleven percent of the respondents in companies with policies said safeguards weren't enforced.
- Nearly 55 percent of the respondents described the files on their hard disk drives as critical to their personal success.
- Nearly 63 percent of the respondents acknowledged that their company had no formal policy describing how or how often data should be backed up to best protect corporate information.
- One in four respondents reported that regular backups began only as a result of personal experience with data loss.

While IntelliQuest's study shows that the need for backup is understood, the numbers indicate that few firms have formal policies to protect themselves from massive data loss.

## Top Ten Disasters



Source: Contingency Planning Research

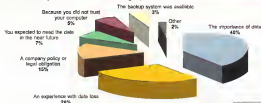
Illustration 4

## PLANNING FOR DISASTER RECOVERY

To develop an effective data protection and recovery plan, it is important to understand where the threats to critical data are most likely to occur (Illustration 4).

- **Hardware Failure** — Not if, but when, is the question. Storage systems can be compromised by a drive failure, controller failure, power failure or a server fault. The most critical failures are those affecting on-line storage devices.
- **User Error** — By far the most common threat to data, and the most difficult to protect against, is human error. The best protection is to limit the amount of harm users can cause, and be able to quickly and easily recover lost or corrupted files.
- **Malicious Intrusion** — Hackers, viruses and computer theft are not primary threats, however, they must be considered. The key to network security is to use every security option possible that doesn't impede legitimate users.
- **Catastrophe** — Perhaps the worst threat to an IS environment is damage by theft, fire, earthquake or other catastrophes. The best protection is to have well-documented disaster plans and procedures. □

## Reasons Respondents Started Backing Up



Source: IntelliQuest

Illustration 5



## Geac, VAR Solution Provider for Property Management and Construction

by Edward Trapaneza

Although it's products are better known than its name, Markham, Ontario based Geac Computer Corp. is a significant systems integrator that sells vertical applications, most prominently in the library, hotel and construction and property management industries. Even though it offers "total solutions" (everything from pre-sale consulting and installation, through hardware and software tailored to specific industries, to training and post sale service and support), it is embarking on a new program of working closely with reseller allies, especially in Western Canada and it could become an important partner to Canadian value-added resellers and wholesalers.

Geac Canada has been growing rapidly, not only by expanding its own product line and customer base, but also through acquiring the assets of other companies. As a result the Geac client list is changing. It includes smaller companies that average between 4 or 5 terminals attached to their systems as well as the larger Geac clients with hundreds of terminals. Geac is looking to its new reseller network to offer the only value added service and support these clients demand.

The long and complex sales cycles required to serve libraries and hotels, two of the vertical industries Geac Canada serves, tends to discourage reseller relationships. However, the sell time is shorter in the construction and property management verticals. Because these industries usually maintain a reseller data processing installation, their primary buying criterion becomes a local supplier who can supply effective support and service.

"We need to look at our distribution channel to make sure that we are providing the customers with what they want," says Michael Rose, Geac Canada's general manager. "Geac has not historically used much indirect distribution but we believe it serves our interest and the interest of our customers much better to utilize a very knowledgeable VAR network to serve these two specific verticals."

In its four vertical markets Geac Canada offers software and open system hardware running on standard operating systems such as UNIX and DOS. But its customer surveys in the construction and property management industries are showing a strong preference for Windows for application software. As a result Geac is introducing *ShedBuilder*, a powerful new Windows based product aimed at the small and medium sized contractor. Michael Rose expects it to be the hottest product in its market within the year.

"Geac is one of the largest supplier of software to the construction industry in the US," Mr. Rose says. "We certainly want to mirror that in Canada but a dealer's make economic sense to put one or two of our own people in each of the major cities in Canada. When you consider the

cost and the effectiveness of distributed network of very specialized VARs is the way to exploit opportunities across the country."

For resellers it's an opportunity to deal with a significant player that is large, stable and financially sound. VARs can count on Geac being there for the long term with a serious commitment to continuous development which provides updates to the installed products. Michael Rose says that despite its longevity, Geac is a new company with a renewed focus on customer satisfaction.

Mr. Rose sees great opportunity in the construction industry. "By making numerous acquisitions we are becoming the market leader in servicing the construction trade and we clearly plan to use our position to develop the best products." □

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Organizations and government agencies are beginning to understand that the information they gather and produce is one of their most valuable resources, yet the sheer volume of data that is being generated today can make that information useless. Information must be readily accessible, just as any resource must be accessible. With increased competition, reduced budgets and smaller staffs, businesses can no longer live with their "corporate database" scattered across multiple departmental servers.

Data warehousing can help an organization maximize the value of its data by becoming the firm's enterprise-wide information exchange facilitator—the central repository where people throughout the organization can share information and experiences to improve decision-making, productivity, and profits. Data warehousing consolidates data previously distributed across incompatible departmental servers into a single, compatible database. It is a blend of relational and multi-dimensional analysis, client/server architecture, multiple databases, and powerful multi data modeling with high-capacity, high-performance data storage.

The reconstitution of volumes of data into a single, centralized database has driven storage capacity requirements to new heights.

### Hidden Costs

IS and network managers who use an ad-hoc approach to increasing their storage (adding large hard drives on a piecemeal basis), are finding that the incremental additions are both expensive and difficult to manage. A better approach is to develop a comprehensive storage blueprint that addresses the issues of scalability, data security, disaster recovery and the total cost of ownership.

In planning their data warehouse storage solution, many organizations focus solely on the hardware and software costs. However, as Figure 1 shows, the direct cost of acquiring and operating the storage system are minor compared to the cost of managing the storage.

The cost of people and resources required for storage space management, performance

tuning, backup and installation must also be considered. While the cost of raw storage is decreasing rapidly, the costs for people and its training. As a result, the costs associated with implementing enterprise-wide storage systems and the personnel to support the storage, are now key considerations in the total cost of ownership.

### Storage Comparisons

Table 1 shows the benefits of large format MO storage solutions compared to alternative systems such as RAID tape, and 5.25-inch MO systems.

While hard drives have a device cost of \$360/MB, a fully configured Terabyte-capacity RAID system (controllers, software, host connections, cabling, engineering, cables, etc.) typically exceeds \$150,000. The sheer number of hard drives required per Terabyte (hundreds) dramatically increases the complexity and reduces the reliability of such a configuration.

Automated tape libraries (ATLs) cost considerably less than hard drives—typically \$200,000 to \$300,000 per Terabyte—however, tape cannot provide the flexibility or longevity that optical provides. It also cannot meet the random access requirements of RDBMS applications.



## Terabyte MO systems provide high-capacity, economical data warehouse solution

By Ray Buckner

and placed even greater emphasis on minimizing the risk of data loss. Clearly, optical technology is the solution, because no other storage medium offers the unique combination of features—high capacity, low storage cost, long-term performance, durability, and high availability that optical provides.

Because data warehouses can grow rapidly into the Terabyte range, scalability of the underlying storage devices is a key consideration. Some analysts estimate that by the end of the decade, organizations in the banking, insurance, utilities and manufacturing industries will have more than 600PB (1,000 TB) of data stored on-line (Table 1).



Jukeboxes that incorporate the new 2.0GB MO disk drives are a step in the right direction; however, the average cost per Terabyte of ten exceeds \$250,000. In addition, the 5.25-inch drives are structured to provide the performance and scalability needed to support Terabytes of randomly distributed data. Because these drives can only provide 1 MB of "data-under-head," 5.25-inch jukeboxes can only achieve about 1GB (or 1%) of on-line data per Terabyte. This means that in a worst case scenario, 99.9% of all requests will require a physical media swap which slows performance and can cause threshold-induced failures.

As a result, 5.25-inch optical jukeboxes are best-suited to moderate transaction rates



## Storage Requirements

## Tune to Electronic Storage

1MB	~500 text pages	Integabyte
500B	~500,000 text pages	Optabyte
1TB	~500 million text pages	Terabyte
1PB	~500 billion text pages	Petabyte
1EB	~500 trillion text pages	Exabyte

## Video

720MB	each NTSC studio quality digital TV frame
33MB	each 286-color VGA computer screen
5MB	each 300 dpi 300x100 image
32MB	each high-resolution color photo

## Audio

22MB	for one hour of telephone-quality recording
62MB	for one hour of CD-quality stereo recording

Table 1

for PC and workstation applications requiring 300 to 300GB of storage capacity

## A Strategy for Success

Large-format MD drives offer clear advantages over all other alternatives (Figure 2). The 4MB/sec transfer rate and 8GB removable cartridge format integrates excellent density-capacity performance which have an average per Terabyte cost of about \$180,000. Depending upon the number of drives included in the sub-system, users can have 3GB, 16GB or up to 48GB of data-under-the-head, effectively creating a virtual RAID in the playback.

With this volume of costs available, robotic swaps are dramatically decreased and the 12-inch subsystems can approach the transaction rate performance of a large RAID at the cost of tape. Additionally combined with RAID and middleware such as Hierarchical Storage Management (HSM) software, a 12-inch MD subsystem is ideal for demanding data warehousing applications because:

- It is the most scalable and cost-effective medium access solution available
- In addition to providing high volumes of data under-the-head and media removability, it offers the performance of hard drives at the cost of tape.
- As a mountable device, it serves a dual function when implemented as a disaster recovery and backup option
- Optical is more reliable than magnetic storage. The media is non-volatile and data is easily recovered in the event of a drive failure. The risk and cost of losing data to a head crash is non-existent. Optical media life is measured in decades, not months or years.

## Data Warehouse Storage Options

	12" Optical	RAID	Tape	9.5" Optical
End-user \$/TB	<\$200K	>\$750K	>\$600K	12/14-400K
Media Capacity	30GB			2.6GB
Avg. time to data	Seconds	Minutes	Minutes	Seconds
Scaled-out Read rate	8MB/s	5-10MB/s	1-2MB/s	5-8MB/s
Media Life	>100 years	N/A	<10 years	>10 years

Table 2

- It is less expensive than RAID and 9.5-inch MD, and faster than 9.5-inch MD and tape.
- The time to "refresh" a large 100GB database index requires no more than 12 media swaps and less than three minutes, compared to months swaps into 77 individual drives and 11 minutes.
- It has a very low duty cycle, providing superior reliability
- With organizations increasingly implementing multi-media and compound document applications files are becoming very large. Imaging and pre-press applications can create files from several megabytes to several gigabytes. Large format MD eliminates the need for managers to spin files across media.

## Data Warehousing Applications

Gartner Group expects the demand for data warehousing to grow from a total market of \$1.5 billion in 1995 to more than \$8.0 billion by 1999. Much of the demand for data warehousing and the faster access to more information it provides came about as a result of the downsizing and cost-cutting measures businesses have had to implement in order to remain competitive. With a data warehousing system in place, users can navigate large corporate data stores in as ad hoc, interactive manner without depending on time-consuming operational systems.

By providing managers with a comprehensive view of all of the available information from a variety of angles, they can make accurate decisions more quickly. Purchasing and finance can quickly and easily obtain complete information on enterprise-wide purchasing and inventory patterns. This can often produce cost savings by eliminating redundant inventory and taking advantage of unknown discount opportunities.

For organizations such as major retailers, who generate and store huge amounts of data from many Point-of-Sale (POS) transactions every day, data warehousing provides vital reports that tie-in data in their marketing and sales strategies. In the past, retail identification took days or weeks as management waited for and culled through multiple batch reports. Now, with complex Structured Query Language (SQL) queries to the

database, they can use "Downstream" and "Drill-down" techniques to instantly analyze sales trends and inventory levels with a high degree of granularity.

Applications such as these place unbelievable demands on the storage/retrieval system — demands that call for an optical playback re-empowering one of the most highly reliable, large-format drives. To assist organizations in managing their data warehousing storage and retrieval needs, Nelson works closely with the industry's leading third-party application software developers as well as leading value-added resellers (VARs) and system integrators around the globe. □

*Any Diskline is senior manager of planning & marketing from Nelson Optical Storage.*

## Storage &amp; Storage Management Expenses



Figure 1



Figure 2

# DLT: The Choice for Reliability

by Michael Kornen

With the advent of network-based computing, storage issues have become more complex. Many companies find themselves in a situation where storage is divided amongst a large number of servers, with individual employees taking responsibility for their own workstation storage. From this environment of barely-controlled chaos, companies are looking towards a more rational, manageable storage solution. Digital Laser Tape (DLT) has an important role to play in this solution.

Every storage technology—disk, tape, optical, RAID—has its place, and the best network storage solution usually involves drawing from the best of available technologies for each part of the solution. For archiving and backup purposes, in an environment where reliability, capacity and transfer speed are more important than random access, DLT is often the best choice.

The reliability of DLT stems from its very design fundamentals, fundamentals which give it an extremely low error rate when compared with other storage technologies. By recording data in 4K blocks which are then split into 2K blocks and run on parallel tracks, both the throughput and the reliability of DLT is increased significantly. When combined with Cyclical Redundancy Checking (CRC) and Error Correction Code (ECC), the design format of DLT can give it one of the lowest error rates around. DLT's ability to detect errors and automatically recover data gives it a reliability rate of less than one unrecoverable error for every 1017 bits read.

This exceeds both Digital Audio Tape (a one error for every 1015 bits read) and 4 mm tape (one error for every 1013 bits read). CRC and ECC also give DLT the ability to reconstruct data, even when as much as 5K of data is lost within a 32K section. And this reliability can be maintained, even after a DLT cartridge has been used more than 3,500 times—almost 10 years of continuous daily use.

For archiving and backup purposes, DLT has a number of other advantages as well. In terms of cost per gigabyte stored, DLT is the cheapest medium (although la-

bor costs may rise over time) and it offers both higher density storage and faster data transfer rates than other tape technologies, including parallel track, helical scan and serial serpentine.

DLT also fits into the high capacity needs of network users. Hard disk capacities were rarely more than 4 gigabytes a few years ago. These days having as much as 8 gigabytes on a single server is not uncommon. With DLT

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## RAID Redux

RAID (Redundant Array of Independent Disks) was originally developed as an inexpensive alternative to traditional methods of storage. RAID takes numerous disks and arranges them so that they appear as a single disk. It then takes data from the virtual disk and maps it onto specific physical locations. This is advantageous because, for the system administrator, there are less objects to manage, certain bottlenecks are eliminated, and it allows files that are larger than one disk to exist. Depending on the way the data is managed, RAID is allocated a specific level from 0 to 5.

Each level is the result of a subtle series of compromises between price, speed and data availability. Depending on the exact nature of the trade-off, different RAID levels will find favor in different fields. Some RAID levels, like 2 and 4, have been superseded by more-lit technologies and are little used now.

**RAID 0:** Uses striping to maintain error correction. Trades availability to get performance. Used in research.

**RAID 1:** Uses striping, plus mirroring and shadowing. Best for data availability. Popular in financial field and in manufacturing, used for databases.

**RAID 2:** Uses striping with hamming code. In little use today.

**RAID 3:** Uses parallel transfers striped across synchronized data disks, plus a parity disk. It trades multi-stream performance and some price to get single-stream performance and availability. Offers the highest bandwidth. Good for servers, CAD, and downloading from satellites.

**RAID 4:** Uses independent striped disks, plus a parity disk. In little use today.

**RAID 5:** Uses striping with parity striped across all disks. Trades price to get availability and modest performance. May be best combination of performance and availability. Good for general time-sharing, manufacturing.

**RAID 6:** Uses striping with parity and additional redundancy. Performance similar to RAID 5.

now being able to hold as much as 20 gigabytes of data (or 40 gigabytes compressed), and transfer it at rates of up to 1.5 megabytes per second, many systems administrators are looking at the technology as a way of keeping up with the ever-increasing backup needs.

And DLT's value should increase as bandwidth on the LAN grows. DLT allows fast backup of data, no matter what its bandwidth. With backup speed limited only by the server, DLT can back up as much as 7 gigabytes of data per hour.

DLT also has a place in theory and some Hierarchical Storage Management (HSM) solutions. Tape libraries based on DLT media are becoming increasingly attractive to systems administrators who find their existing storage systems approaching saturation and find their need for readily accessible data is fast outstripping their ability to pay for it. A good tape library will store large volumes of data safely, while still providing quick access to information. In addition, a tape library, based on DLT media, will offer some of the longest-lasting, and most reliable data storage around — as much as five times longer than helical scan devices, for example. Tape libraries also offer high capacity. A DLT library with 264 cartridges can store up to a whopping 3.2 terabytes of data, or the equivalent of an eight million page file cabinet. When storage needs



are even larger, system administrators can link tape libraries together.

But one of the best advantages of a good tape library is its ability to provide backup storage that is unattended. With no operator intervention, tape-handling errors are reduced while the systems administrator is freed to concentrate on other tasks.

Some HSM solutions include DLT while others are based on optical media.

Whether a systems administrator chooses DLT or optical depends upon the type of applications planned. DLT is best suited for the storage and retrieval of large objects particularly if the objects' data organization is sequential. Optical storage is best suited for applications requiring access to small objects such as those found in permanent archives or imaging applications.

As the data storage needs of networks continue to grow, the storage capacity of DLT is expected to grow with it. Already research into DLT is expected to yield higher capacity by the end of this year. DLT's place in the necessary of storage solutions is assured for a while yet. □



Michael Kremen is the general manager of the Willowdale, Ont.-based Storage Business Unit of Digital Equipment of Canada.

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E-Mail: [maccon@maccon.ca](mailto:maccon@maccon.ca)

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Montreal, Que. Tel. (514) 412-0970 Fax. (514) 412-1000

**Maxell Canada**

111 Vaughan Dr., Richmond Hill, Ont. L4B 3G2

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Maxell Canada is the Canadian branch of Maxell. Products include notebook data cartridges, diskettes, optical disks, CD-ROM and Superdisk cartridges as well as electronic audio and video tape and hardware

**Direct office:**

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**McKinnon Micro Distributing**

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Tel. (604) 270-9671 Fax. (604) 270-9660

McKinnon Micro distributes a wide range of multimedia products and services including the most complete line of software and workbooks into the desktop. They stock top line and value priced IBM PCs, Macintosh from IBM, Tandy and Art Media. Hard Drives from Western Digital, Quantum and Compaq. Hard disk up from Truevision, Creative, Graphics, Adaptec from ATI, Diamond, Creative, and Video, Soundcards by Soundblaster, EISA, P, Modern from Apple, Wave Proprietary, from from Pioneer and Denon, CD-ROM Drives from Pioneer, Acer, Creative, VCD, Harddisk Array Drives and Final Harddisk Cards from Iomega, & Harddisk VCD, Multimedia, non-computer, Video and Creative, Life Speakers and Music players by JBL and Sony, & Japan to from Samsung, Creative and Quantum, keyboards and Mouse from Quantum, Sony, IBM and Logitech

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Tel. (604) 276-0110

A national distributor of networking products, computer systems, CPUs, motherboards, keyboards and more. Also a provider of sales rep

**Mervel Canada**

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**Micrograte**

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Index system for Taurus marketing computer networks. Sales, product status and performance. A distributor of multimedia peripherals. CD-ROM software, computer systems, components and peripherals.

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A distributor of videographic cards, monitors, monitors, keyboards, notebooks and printers.

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61 Avenue Road, Suite 203, Toronto, Ont. M5R 2H7  
Tel: (416) 442-6527 Fax: (416) 445-0229

PC DOCS is a client/server document management system providing a secure environment for LAN and WAN.

**PC One Two Three Computer Corp.**

1120 Rega, Suite 180, St. Laurent, Que. H4M 1A7  
Tel: (514) 499-6840 Fax: (514) 499-5477

Distributor of computer desktop systems, notebooks such as IBM, Hewlett, Compaq, Zenith products, Peripherals products.

Branch office

Quebec City, Que. Tel: (418) 672-1192 Fax: (418) 672-6164

**Perfect Solution Multimedia Inc.**

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Tel: (905) 885-6868 Fax: (905) 882-8833

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**Peripheral Express Inc.**

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A national distributor/wholesaler of monitors, floppy drives, keyboards and CD-ROM products. Also various printers, modems, hard drives and more.

Branch office

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**Pette Systems Ltd.**

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Pette Systems Ltd. is a manufacturer of video cameras, and a marketing partner for IBM Multimage systems. Pette Systems operates in products that make it easy to connect a wide variety of PCs, desktop printers and other devices to IBM AS/400 systems. Pette supports customers on Taurus AS/31 Token Ring Systems and X.25 Pette links printers, the Pette 475 is a Remote Access Unit for Ethernet LAN access.

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**Pioneer Electronic of Canada Inc.**

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Telex: 1-800-494-6464

National distributor of full line IBM brand personal operating systems and products including disks, CD-R, then again, IBM-PC and IBM, a variety of IBM PC-compatible accessories. Importer and distributor of AME & Higher grade printer desktop and full line accessories. Also Canadian distributor of various IBM for USA made CDS/DVDs in word data/CDD duplication equipment. Various accessories are also available.

**Pro-Data**

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Provincial is a supply point-based independent sales network program for the printed circuit PCB layout. Users play in a computer TV YCL, or any video card or other PC. The publisher's supply is in 1/4 inch of a unit and is high in 1/8 inch resolution in 1/4 inch resolution.

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Tel: (905) 484-8777 Fax: (905) 484-8766

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3600 Sheppard Ave. E., Scarborough, Ont. L4V 1P2  
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A distributor of computer hardware and peripherals.

**Radix Inc., Canada**

280 St. Lawrence, Toronto, Ont. M5A 1J2  
Tel: (416) 412-5660 Fax: (416) 477-9511

The company has been extended system performance a full range graphics and digital video in the publishing, graphics and education markets.

**RC Electronics Canada**

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**Samsung Electronics Canada Inc.**

1007 Finch Ave. E., Markham, Ont. L3N 9E7  
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A manufacturer of desktop printers, CD-ROM drives, modems, disk drives and for home, business brands such as Samsung, IBM, and more. All products are available through authorized distributors.

**Sanitech Computer, Inc.**

177 Brady St., Markham, Ont. L3R 9V3  
Tel: (905) 942-7680 Fax: (905) 945-8333

Sanitech's product line includes monitors, controllers, video cards, CPUs, memory, power supplies, cables, drives, keyboards, modems, CD-ROMs, printers, and more. The company is a direct component, CD-ROM sales and complete finished PCs.

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6000, 7070-7070, Suite 100, Mississauga, Ont. L4V 1L7  
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**Some 3 Interactive Distributors**

700 N. High St., Suite 100, Windsor, Ont. N9L 1C3  
Tel: (519) 254-0444 Fax: (519) 254-0444

Some 3 is the exclusive distributor for many interactive games for sale, among the Canadian market.

**Source Technology Inc.**

7000 E. 1st Ave., City of Mississauga, Ont. L4R 5V9  
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Seprite Technologies, a ISO 9000 manufacturer, offers products to modify or replace video demand satellite receiver and notebook computers. Latest releases include its 1000-series line panel LCDs with edge-to-edge viewing of 32" x 11.7" and 11.7" x 9" active matrix screens. Featuring 16, 65,000, and low-line 256 colors, these panels are designed for critical applications for banking, government, health, and information systems in the classroom. The "plug and play" display series is a full line of 14, 15, 17, and 21 inch WXGA and SXGA displays for general business applications. All modules have high resolution, VGA and XGA compliance, built-in video, digital and analog controls. These monitors combined with VGA compatible video cards maximize Windows file plug and play features. The microchannel format, 4800 resolution, offers speed up to 100MHz for corporate power users and subsequent sales. For a more complete CD-ROM drive can be replaced with other I/O modules including 144 floppy drive or second battery for increased operating time.

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8440 46th Highway W., Richmond B.C. V6V 0V6  
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175 Simco Road, London, Ont. N6A 6C7  
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Internet: [starstech.com/starstech.com](http://starstech.com/starstech.com)  
StarTech Computer Products is a manufacturer/distributor serving Canada, the U.S., and Europe. The company specializes in Network Server Management Tools, LAN Adapters, Network Print Servers, Peripheral Sharing Devices, and all types of computer cables.

### STD Systems Inc.

860 Concession Court, London, Ont. N6C 3K7  
Tel: (519) 466-8833 Fax: (519) 466-9119  
Website: <http://www.std.com>  
STD is one of the largest computer manufacturers in Canada with 11 sales territories. It manufactures and distributes a new line of Compaq/Pro and STD brand computers.

STD is also the first Canadian OEM manufacturer for Compaq/Pro workstations and a very large dealer in any Power brand name, including Motorola's Alpha PowerPC workstation. It is also the national distributor of Compaq/Pro and CTS computer desktop printers, Evers and CTS modems, value added channels of Personal optical printers, hard processors and accessories. Moreover, STD and PC manufacturers more strategic and marketing products are STD with National Music Grouping Office supplies for the Canadian Federal Government.

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A manufacturer and developer of industrial computer products including for business PCs, industrial desktop PCs and rugged portable PCs.

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11



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The evolution of storage:

# Yesterday, today & tomorrow



by Alex Zisman

**W**here does your data go when you flip off the power switch?

Unless you've saved your file, the answer, of course, is to that big hot-bucket in the sky—in other words, it's gone unless you've saved it. Your computer needs storage... not just to save your data files, but to store your applications, and even the operating system. Without being able to read and write files, your computer would be a mere shadow of itself.

Not unlike, mind you—we use a lot more computers than we're aware of, mostly in the form of embedded processors. CPUs with a relatively small amount of instructions permanently burned into ROM chips, in our cars, cameras, microwave, and VCRs. But without storage, these computers are limited to a single purpose... not really computers as we know them.

## Yesterday...

For the first personal computers, storage was slow and unreliable—paper tapes on the primitive Altair, cassette tapes on later Commodore VIC-20s, for example. Even the first IBM Personal Computer had a pan for a cassette player. But a big breakthrough came when Apple co-founder Steve Wozniak designed a floppy-drive interface for the Apple II, permitting it to use relatively fast cheap and reliable disks. Even though

floppy disks were no extra-cost add-on for these early Apples and IBMs, they were clearly the way to go.

Floppy diskettes started to rise and grew in capacity from the 160Kb 5 $\frac{1}{4}$ " disks of those first IBM PCs to 360Kb double-sided, double-density disks of IBM's AT to the 1.2 meg 5 $\frac{1}{4}$ " AT diskettes. Smaller, more durable 3 $\frac{1}{2}$ " diskettes were first popularized as 400Kb Miniscribe models in 1984's ground-breaking Apple IIx series, growing in capacity to 800Kb and then 1.44 meg models now standard on both Macs and PCs. (And yes, these hard-shelled diskettes are still floppy disks... break one open and see.)

IBM tried to establish a higher-density standard, 2.88 meg diskettes, in the late 80s, but these have failed to become popular—drives and disks are rare and expensive; rather than that, floppy disk technology has long left all most new computers to make room for CD-ROM players.

Even though a 1.44 meg diskette holds almost ten times as much as the initial generation of floppies, even users of early personal computers ran into problems. You quickly ended up with a collection of floppies and had to shuffle between them. And applications soon appeared to require diskettes—you might have to swap disks to spell check your word processor file.

Continued on page 20

Continued from page 51

Mainframe and minicomputer users had been making use of a technology that used rigid platters—hence the name hard disks. Some models were removable, but more stayed in a permanent stack in a unit with multiple platters—IBM (which offers platters for its own systems for things) called these fixed disks. But these were too big and too expensive for personal computers. Even when they were scaled down to 5 $\frac{1}{4}$ " size to fit in a PC, a hard drive with a five-megabyte 5 megabytes of storage might cost \$1000 or so.

A breakthrough occurred in 1980, when IBM introduced its XT model—basically a barely upgraded original PC, but with a 10 meg hard drive included. A year later, the XT doubled that, with a 20 meg drive—going over the 640K limit of the original PC. By the end of the year, over 35,000 machines were in use, and the XT was the key business computer of the mid-80s. WordStar, WordPerfect, and dBase, along with your data.

Even then, there were alternatives. Some users preferred removable storage, and companies like Intertec and Syquest provided it. Prime Minister John Gummer, in his Vancouver office, for instance, used a PC together with a unit offering four 10-meg Intertec Bernoulli boxes, a total of 20 meg of removable storage.

# Today...

## Today...

Hard drives have shrunk in size and cost, while growing tremendously in capacity and reliability.

In 1988, I purchased a 40 meg hard disk on sale for \$400... today, a gigabyte (a billion bytes)—25 times as large) drive is about 1/4 the size, and little more than half the price. And by the end of the year, expect that gigabyte drives will be the standard capacity offered on computers aimed for home and business use.

Inside, these units still look like miniatures of a 1970s-style hard drive—a stack of metal platters, spinning at high speed. But breakthroughs in the technology of packing magnetic information onto the disks has made it possible to manufacture small, high-capacity drives for the same cost as the much less capable units of even two years ago.

At the same time, newer PCs include support for larger drives—so-called Logical Block Addressing (LBA) built in, making it easy to add drives larger than 512 meg—formerly a limitation that could only be overcome with special hardware or software.

Drives are available in two basic flavors: EIDE is the common standard for PCs—now that the 512 meg limitation has been bypassed, permitting cheap, high capacity drives. SCSI, first made common on Apple Macintosh models, also permits high capacity drives, and can provide performance and features beyond EIDE. SCSI remains non-standard on PCs, however, and is a snail. SCSI drives cost more than their EIDE equivalents (and users also typically need to purchase a \$200-\$300 adapter).

Syquest's Syquest II



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Continued from page 190

# Tomorrow?

## Tomorrow?

It seems clear that hard drive capacities are going to continue to increase, at least for a while, with graphics capacities becoming standard, and multi-gig units increasingly common and affordable.

The biggest changes, however, seem to be happening with removable storage. Since the adoption of the 1.44 meg floppy almost a decade ago, this area had been pretty stagnant; users needing higher capacities (typically graphics professionals, using Macs) tended to stick with the 40-meg Syquest cartridges, which, requiring SCSI, were rare among PC users.

The past year has changed all that. Immedia's ZIP drive, a \$300 (CDN) unit using 100 meg disks costing about \$20 each, has threatened to become a new standard. It's available in SCSI models for both Mac and PC, and in a parallel-port PC unit, which while slower than the SCSI version can be easily moved from computer to computer.

(SCSI users may prefer Syquest's faster and higher capacity EZ-135—unfortunately, the Syquest and Immedia models can't share disks.)

But 100-135 megs may not be enough, and both Immedia and Syquest are among the companies offering even higher capacity removable storage at relatively affordable prices. Again, Immedia appears to be first off the mark—their flu drive is just starting to become available, offering both internal and external (SCSI only) drives using massive 1-gig cartridges. At about \$600 (US) for the drive, and \$100 (US) per cartridge, these are usually pricier than hard drives, but become increasingly economical as more cartridges are purchased. And performance promises to be within the range of hard drive performance.

Even tape is making a bit of a comeback. Slow and linear, it isn't going to replace hard drives or diskettes for storing often-used programs or data, but it has built a niche as a low-cost medium for back-up purposes. Recently low cost drives have become available from a number of companies, using 800 meg Tapes. At \$40 per tape, these are quickly replacing the older but more expensive drives running QIC-80 style tapes. (The



There are units that also use the older QIC-80 tapes. And parallel-port tape drives, such as MicroSolutions' BackPack or Immedia's Data can be easily used to backup multiple PCs' data, while costing only around \$250 (CDN). Note that as with the parallel port ZIP drive, parallel port tape drive performance can be increased dramatically using enhanced or ECP parallel ports.

Again, SCSI provides the high end alternative. SCSI-based DAT tape drives can achieve a couple of gigabytes of data onto a standard digital audio cassette tape—about \$10 per cassette, but the drives themselves will cost around \$2,000.

For a time, it seemed as if recordable-CD-ROM (CD-R) would become a new standard medium, but it is proving to be, at least in the short term.

Writable CD drives remain expensive, hovering around \$1,000 or more, and are important, difficult to use. Users need a fast, big hard drive, with a CD's worth of unfragmented free space (about 650 megs). Even then, recording remains hit and miss—users often find they've ruined a 520 one-time blank disk. And the CD standard is about to change—from the 650 meg DVD (also known as 5D-ROM). Expect high-priced DVD units near the end of the year, with a couple of years before this becomes a widespread standard.

For the near future, at a minimum, look for gigabyte or larger EIDE hard drives in entry-level machines. Hopefully, enhanced (or ECP) parallel ports will become standard, as more and more drives are sold making good use of the added performance and convenience of these ports. Built-in SCSI may become more common on mid-level machines, making it possible for buyers of these units to make use of devices such as the flu drive. Higher end machines may even start offering internal flu drives for fast, high-capacity removable storage. ☐

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